ABSTRACT

Using climate and weather variability to model human outbreaks of *Salmonella* and *Campylobacter* and their environmental prevalence in Georgia watersheds

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Globally, microbiological contamination of water is the most common source of diarrhea-causing pathogens; and as, such, may be the number one cause of childhood mortality. In the United States alone nine million cases of waterborne may occur annually. Although numerous factors likely contribute to the disease burden, there is growing evidence that climatic variability, including changes in temperature and especially precipitation, is associated with outbreaks of intestinal diseases. In the United States and elsewhere *Salmonella* spp. And *Campylobacter* spp. continue to cause significant enteric disease. *Campylobacter* is the most commonly reported cause of acute bacterial gastroenteritis in developed countries; it is also frequently associated with poultry and other livestock and is transmitted by the water route. Likewise, *Salmonella*, also a common zoonotic agent transmitted by water, is one of the top three causes of waterborne disease. Seasonality in human outbreaks and environmental prevalence of both pathogens has been noted in the literature with peaks reported generally in the summer months. In the United Kingdom, *Campylobacter* detections in watersheds and abattoirs increase with or just prior to peaks in human cases in the late spring and early summer. The highest frequency of *Salmonella* isolations from humans occurs in late summer (August and September) – months also associated with increased rainfall, particularly in the southeast United States, and densities of *Salmonella* in surface waters.

In this study we propose a multi-tiered modeling approach to define the contribution of climate and weather variability to both environmental prevalence and incidence of disease in Georgia watersheds. A retrospective study will first identify watersheds/regions with a sight incidence of disease (campylobacteriosis and salmonellosis). Using historical data collected by the state and federal agencies, the association of disease to the El Niño-Southern Oscillation and to local weather will be statistically analyzed. Concurrently, we will evaluate the statistical relationship of the ENSO to precipitation and streamflow in watersheds with high disease rates. Finally, in a prospective study three watersheds, identified to have a strong connection between disease and climate, will be surveyed for environmental prevalence and clinical cases (as determine by hospital discharge ICD9 codes) of both pathogens and gastroenteritis in general. By examining the geographic and temporal distribution of clinical cases and detection in the environment in the context of climate and weather variability, we can model and begin to predict outbreaks under various climate scenarios. This study will generate predictive models of human case data reported to the Georgia Division of Public Health based upon watershed and climatic data. This information will be disseminated regionally in the Georgia Epidemiology Report – a regular newsletter distributed by the Georgia Division of Public Health and available online. In addition, the Georgia Division of Public Health is in a unique position to utilize the information generated form these models.